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ABSTRACT

In addition to data on teacher performance and student learning, the Beginning Teacher Evaluation Study, Phase II collected data on the aptitudes, attitudes, knowledge, and personal characteristics of 95 second and fifth grade teachers and their students. This permitted the investigation of the relation of cognitive style to a number of variables relevant to how teachers teach and students learn. Results indicated that for teachers cognitive style was significantly related to aptitude, satisfaction, and certain performances for specific subject matters and grade levels. It was not consistently related to those teaching performances which predicted student learning. For students, cognitive style was differentially related to student learning for different subject matters and at different grade levels. Except for decoding, cognitive style contributed more to learning in both reading and mathematics at the second grade level than it did at the fifth grade level. In addition, while the contribution of cognitive style to learning decreased between second and fifth grade, the contribution of aptitude increased. The findings consistently supported the hypothesis that cognitive style, acting as a mediating or process variable, had more impact when a child was first learning these particular reading and mathematics skills. (RC)

PR-76-19

BEGINNING TEACHER EVALUATION STUDY
PHASE II 1973-74

CORRELATES OF TEACHER AND STUDENT COGNITIVE STYLE

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CORRELATES OF TEACHER AND STUDENT COGNITIVE STYLE

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A study conducted by Educational Testing Service
for the California Commission for Teacher Preparation
and Licensing and funded by the National Institute
of Education and Educational Testing Service.

PREFACE

The Beginning Teacher Evaluation Study (BTES) is a long-term project of the California Commission for Teacher Preparation and Licensing. The Commission is responsible for licensing teachers in California and is trying to determine what factors should be considered in this process.

The second phase of the study was conducted by Educational Testing Service for the Commission. Phase II was the hypotheses-generating and instrument-development phase of BTES. ETS had two tasks: (1) to develop an assessment system to measure both teacher and pupil behaviors as well as other factors which might be related to these behaviors; and (2) to generate hypotheses about the interrelationships between teacher and pupil behaviors and related factors.

The study was conducted in 43 schools in eight districts throughout the state of California. A total of 41 second grade teachers and 54 fifth grade teachers participated in the project during Phase II.

The final report for Phase II consists of several volumes. Volume I describes the design and rationale for the experimental design and data analysis procedures and includes the major findings of Phase II. Volume II describes the conduct of the field study and the sample of participants.

Because of the complex nature of Phase II, a variety of techniques was used to measure teacher and pupil behaviors. They are described in Volumes III, IV, and V. Results are also included in these volumes.

Volume III describes the observation systems in detail and is available in three separately bound sections. The first section, Volume III.1., describes the behavior recording observation system used in the project--APPLE (Anectdotal Process for Promoting the Learning Experience). Volume III.2. describes the category system used to observe classroom activities--

RAMOS (Reading and Mathematics Observation System). The third section of this volume, III.3., covers the videotaping of instructional activities during reading and mathematics.

Volume IV concerns other aspects of the measurement system and covers both the pupil and teacher test batteries.

The fifth volume covers a series of small studies done as part of Phase II. Volume V.1. looks at teacher aptitudes as related to teacher behaviors. Volume V.2. is concerned with the relationship between teacher expectations and pupil performance. Volume V.3. reviews performance of pupils in the BTES teachers' classrooms for two years prior to Phase II, the historical test data. Volume V.4. discusses the Diagnostic Film Test, a device designed to assess teachers' skills in diagnosing reading problems and prescribing corrective action. Volume V.5. summarizes the results of work diaries completed by the teachers on their reading and mathematics instructional program.

Information on the availability of these volumes can be obtained from:

Dr. Frederick J. McDonald
Educational Studies
Educational Testing Service
Princeton, NJ 08540

Information on other phases of BTES can be obtained from:

California Commission for Teacher
Preparation and Licensing
1020 O Street
Sacramento, CA 95814

The study reported here on cognitive style was not part of the original project, but an offshoot of it and was funded by Educational Testing Service.

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The Beginning Teacher Evaluation Study (McDonald and Elias, 1976) was designed to provide data to investigate several types of questions concerning the role of cognitive style in teaching and learning. Cognitive style is an individual difference variable defined as a consistent mode of information processing. The field-dependence-independence dimension of cognitive style is a continuum, with the field-dependent end characterized by a more global, undifferentiated approach and the field-independent end by a more analytical, differentiated approach to perceptual processing. An individual with greater psychological differentiation tends to deal with elements as discrete from their context and thus is able to reorganize or restructure them. Such analysis and structuring may be viewed as mediating processes which are more available to the field-independent person. The field-dependent person, on the other hand, has less recourse to such mediators and tends to experience his environment in a more global fashion.

The disposition to process information in a more-differentiated or less-differentiated manner is reflected in social as well as intellectual behavior. Thus the field-independent person perceives himself as distinct from his social environment to a much greater degree than does the field-dependent person. While a field-independent person is likely to reveal his competence in aspects of cognitive functioning which require an analytical orientation, the field-dependent person shows his strength in aspects of social functioning which require attention and sensitivity to others (Witkin, Dyk, Faterson, Goodenough & Karp, 1962; Witkin, 1974; Goodenough, 1975; Witkin and Goodenough, 1976).

This cognitive style dimension has been shown to relate to both how teachers teach and how students learn. Field-dependent teachers tend to prefer teaching

situations which allow for interaction with the students, whereas, field-independent teachers prefer more impersonal situations and tend to stress the cognitive aspects of teaching (Witkin, Moore, Goodenough, and Cox, 1975). Thus field-dependent teachers consider discussions more important in teaching while field-independent teachers consider lecture and discovery approaches more important. Relatively field-dependent and field-independent teachers may also differ in their use of reinforcement. In one study field-independent teachers reported that they considered both corrective feedback and negative evaluation to be effective teaching techniques while field-dependent teachers did not (Emmerich, cited in Witkin, et al, 1975). Research in this area has been based primarily on stated preferences and self-report of teaching behavior while studies involving direct observation of field-dependent and field-independent teachers in their classrooms are just beginning.

The field-dependence-independence dimension of cognitive style also relates to how children learn. Due to their greater social sensitivity, field-dependent children tend to be more adept at learning and remembering materials that have social content, and to be more affected by criticism than field-independent children. On the other hand, field-independent children are more able to impose their own structure on ambiguous or unstructured learning tasks (Witkin, Moore, Goodenough, and Cox, 1975).

Significant relations, independent of intelligence, have been found between certain types of reading and mathematics tasks and cognitive style. As would be expected, those tasks requiring a more analytical orientation are related to field independence. In reading, these are word recognition, phonetic knowledge, and certain kinds of comprehension questions requiring

reorganization of a field to solve a problem (Gluck, 1973; Cohn, 1968). In general, field-independence is related to mathematics tasks to a greater extent than reading tasks, and within mathematics it relates more to application and problem solving tasks than it does to computation (Perney, 1971; Satterly, 1976).

After a comprehensive review of the literature on cognitive style and its relation to learning and memory, Goodenough (1975) concluded that individual differences in field-dependence-independence make a difference in how one learns, rather than in how much one learns. If field-dependence-independence is viewed as a mediating variable one might expect it to have more impact when a child is first learning a task or skill. Once the child gains some familiarity with a task, the need for analysis and structuring necessary for initial learning of the task may be reduced or compensated for by other means.

In addition to data on teacher performance and student learning, the Beginning Teacher Evaluation Study collected data on the aptitudes, attitudes, knowledge and personal characteristics of the 95 second and fifth grade teachers and their students. This enabled us to investigate the relation of cognitive style to a number of variables relevant to how teachers teach and students learn. The results of this analysis are organized around six questions:

1. What personal characteristics are associated with relatively field-dependent and field-independent teachers?

2. Is field-dependence-independence differentially related to teaching performance?

3. Are performances characteristic of either field-dependent or field-independent teachers associated with differential learning on the part of their students?

4. What personal characteristics are associated with relatively field-dependent and field-independent students?

5. Is field-dependence-independence differentially related to learning in different subject matters at different grade levels? and

6. To what extent does field-independence contribute to the learning of different reading and mathematics skills at the two grade levels?

Cognitive style was measured with three forms of the Group Embedded Figures Test.[1] Each of these tests contains a series of items which require the individual to find and trace a simple figure which has been embedded in a complex design. Teachers received the adult version, fifth grade students received the same version with appropriately modified directions and second grade students were given a specially adapted group version of the Children's Embedded Figures Test. Teacher characteristics and attitudes were assessed by questionnaire, while aptitudes and knowledge were assessed via a comprehensive test battery. Two in-class observation systems, RAMOS and APPLE, plus a self-report Work Diary, were used to collect teacher performance data. Student characteristics information was collected from both teachers and parents. Student aptitudes, attitudes, expectations and learning were assessed by a comprehensive test battery given in the fall and the following spring (McDonald and Elias, 1976).

1. What personal characteristics are associated with relatively field-dependent and field-independent teachers?

The correlations of Group Embedded Figures Test scores with teacher characteristics, perceptions of school organization, attitudes knowledge, and aptitudes are presented in Table 1. For both second and

[1] Published by Consulting Psychologists Press, Inc., Palo Alto, California.

TABLE 1

THE CORRELATIONS (r) BETWEEN TEACHER CHARACTERISTICS AND TEACHER COGNITIVE STYLE

	Second Grade Reading N = 40	Second Grade Math N = 41	Fifth Grade Reading N = 53	Fifth Grad Math N = 54
[illegible]	- .27	- .26	- .17	- .18
[illegible]	- .51**	- .52**	- .05	- .06
[illegible] - SCH	- .15	- .17	.07	.06
[illegible] - TEACH	- .47**	- .45**	- .09	- .10
[illegible] LEVEL	.05	.09	- .14	- .13
[illegible]RA T + A	- .10	.07	- .05	- .04
[illegible]T FUNDING	- .07	- .07	.10	- .11
[illegible]N. CHANGE	.13	.17	.05	.03
[illegible]T COMPLEXITY	.06	.10	- .06	- .04
[illegible]MING	.15	.17	- .23	- .25
[illegible]CENCUS	.02	.00	- .02	- .03
[illegible]TRAL DECISION MKG.	- .27	- .29	- .42**	- .45**
[illegible]N HELP	.24	.28	.38**	.39**
[illegible]T STYLE	.00	.01	- .02	- .01
[illegible]N STYLE	.06	.05	- .05	- .06
[illegible]C PRIN STYLE	- .39**	- .44**	- .28*	- .30*
[illegible]SS CLIMATE	- .10	- .06	- .28*	- .30*
[illegible]IRATION	- .14	- .07	- .18	- .21
[illegible]ISFACTION	- .37*	- .39**	- .41**	- .44**
[illegible]C STUDENTS	- .02	- .07	.06	.07
[illegible]CHING KNOWLEDGE	- .16	.40**	.53**	.55**
[illegible]JECT KNOWLEDGE	.39**	.29	.57**	.20
[illegible]BAL FLUENCY	.54**	.56**	.59**	.60**
[illegible]ORY	.38**	.41**	.35**	.36**
[illegible]SONING	.43**	.43**	.62**	.63**
[illegible]XIBILITY	.61**	.60**	.65**	.66**

*p ≥ .05 if r ≥ .30
**p ≥ .01 if r ≥ .39

*p ≥ .05 if r ≥ .27
**p ≥ .01 if r ≥ .35

fifth grade teachers field dependence (low GEFT score) is associated with perceiving the principal's administrative style as more democratic, and deriving more satisfaction from his or her job. In addition, field dependence for second grade teachers is associated with being older and having taught longer. It appears from this pattern that a field-dependent orientation is more compatible with elementary teaching than a field-independent one especially in the early grades.

Field independence at both grade levels is associated with all four aptitude factors, as well as knowledge of teaching methodology and of subject matter. These high correlations were unexpected as a review of previous research indicated that the relation between GEFT and verbal aptitude was only about .18 (Witkin, Moore, Goodenough and Cox, 1975).

2. Is field-dependence-independence differentially related to teaching performance?

Path analysis was used to analyze the relation between teacher aptitudes and teacher performance. Cognitive style was hypothesized to be causally related to teacher performance and through performance to student learning. The significant path coefficients are presented in Table 2 and the descriptions of the performances are in Table 3. Different patterns emerge both between grade levels and between subject matter within grade level. At the second grade, most of the significant path coefficients for both reading and mathematics are negative. Field-dependent teachers are more likely to spend time in direct instruction (R-1), in practice or review of skills and facts (R-2), and to use more instructional materials (R-3). Their instruction

TABLE 2

SIGNIFICANT PATH COEFFICIENTS FROM TEACHER COGNITIVE STYLE TO TEACHER PERFORMANCE VARIABLES

	Second Grade Reading (N = 40)	Second Grade Math (N = 41)	Fifth Grade Reading (N = 53)	Fifth Grade Math (N = 54)
WD-1			- .33 n	n
WD-2	- .44	p	+ .26	
WD-3		+ .25		+ .42
WD-4	n	- .59 n		p
WD-5	- .38			
R-1	- .41	- .37		
R-2	- .54 n	- .33	+ .45	
R-3	- .37 p	- .31	n	n
R-4	- .28		p	+ .34
AP-5			- .37	n
AP-6				p
AP-7		n	+ .31	
AP-8	+ .25		n	- .33
AP-9	- .60	- .34 n	+ .25	
AP-10	- .46		+ .45	+ .60 p
AP-11		p		- .25
AP-12	- .42		+ .51	
AP-13	- .32	- .51	- .25	- .33 p
AP-14				+ .31

p = positive predictor of student learning.

n = negative predictor of student learning.

TABLE 3

DESCRIPTION OF TEACHER PERFORMANCE VARIABLES

WD-1: Time spent preparing for and teaching reading or mathematics.

WD-2: Variety of specific skills taught.

WD-3: Quality of teaching methodology.

WD-4: Complexity of classroom structure: weighted by teacher doing most of the teaching.

WD-5: Variety of instructional mate[illegible] number used.

R-1: Time spent in direct instruction and facilitation.

R-2: Variety of instructional goals: weighted by practice and review.

R-3: Variety of instructional materials: books, workbooks, paper and pencils.

R-4: Variety of instructional activities: weighted by individual seatwork.

AP-5: Amount of independent seatwork.

AP-6: Teacher-group context.

AP-7: Teacher-class context.

AP-8: Organizing for instruction: weighted by work with an individual, group or class.

AP-9: Spot checking progress: answering, asking, checking.

AP-10: Sustained interaction: explaining, discussing, questioning.

AP-11: Location of teacher: weighted by circulating.

AP-12: Responsiveness to individual pupils: weighted by positive feedback.

AP-13: Control of individual pupil behavior: weighted by redirecting.

AP-14: Nonresponsiveness to individual pupil behavior.

is often the spot-check, question-and-answer type (AP-9) and they rely on interactive techniques, primarily redirection, to manage their classes (AP-13).

The sign of the significant path coefficients changes between grade levels; for fifth-grade teachers most of the significant path coefficients are associated with field independence. Here only two teacher performances have significant paths for both reading and mathematics: field-in[illegible]nt teachers typically employ the instructional techniques of expl[illegible] discussion and more sustained questioning (AP-10); while field-dependent teachers are again more likely to use interactive techniques such as redirecting to manage their classes (AP-13). Greater use of these interactive techniques, which is typical of field-dependent teachers across grade level and subject matter, is the only performance which exhibits such a consistent relation to cognitive style.

Indeed, several of the performances characteristic of field-dependent teachers at second grade are characteristic of field-independent teachers at fifth grade. This finding suggests that the relation between field-dependence-independence and teaching performance is associated with grade level and probably influenced by the teaching task.

3. Are the performances characteristic of either field-dependent or field-independent teachers associated with differential learning on the part of their students?

Stepwise regressions of the nineteen teacher performance variables were performed with both residual scores and mean gain scores. These

analyses produced the pattern of performances which contributed significantly to student learning. Again different patterns were found for each of the two grades and content areas. Significant positive predictors are noted in Table 2 by the letter "p," while significant negative predictors are noted by an "n."

While four of the seven predictors are related to cognitive style for second grade teachers, notice that both positive and negative predictors are associated with field-dependence. At the fifth grade, only three of the eleven predictors are associated with cognitive style and again both positive and negative predictors are associated with field dependence, while one positive predictor is associated with field independence.

It is evident from this analysis that the majority of teaching performances which predict student learning are not more characteristic of either field-dependent or field-independent teachers. As with learning, cognitive style appears influences how one teaches, rather than how effectively one teaches.

4. What personal characteristics are associated with relatively field-dependent and field-independent students?

The original correlations and first-order partial correlations between cognitive style, aptitude and student characteristics appear in Table 4. At both second and fifth grade, field-independent students are more likely to come from higher SES families, have better educated parents, have gone to a preschool other than Headstart and to read books and

APTITUDE (SFTAA) AND COGNITIVE STYLE (GEFT) CORRELATIONS (r) WITH STUDENT CHARACTERISTICS: SECOND GRADE READING (N ≥ 750)

CHARACTERISTIC (1)	APTITUDE (2)	COG. ST. (3)	APTITUDE -COG. ST. $r_{12 \cdot 3}$	COG. ST. - APTITUDE $r_{13 \cdot 2}$
SEX- PS	.00	- .02	.02.	- .03
SES-PS*	.44**	.22**	.39**	.01
SES-PQ	.30**	.18**	.24**	.05
M-ED-PQ	.37**	.23**	.30**	.07*
F-ED-PQ	.41**	.25**	.34**	.07*
M-MATH-PQ	.31**	.14**	.28**	- .01
F-MATH-PQ	.26**	.24**	.17**	.14**
P-ACT-PQ	- .08*	- .13**	- .02	- .10**
F-THRU-PQ	- .16**	.04	- .21**	.14**
HD-ST-PQ	- .13**	- .05	- .12**	.01
TITLE I-PS	- .05	- .08*	- .02	- .06*
BILING-PS	- .13**	- .06	- .11**	.01
REMED-PS	- .13**	- .06	- .12**	.01
MILUH-PS	- .06	- .10*	- .01	- .08**
OTHER-PS	.10*	.08*	.07*	.03
PRESCH-ED	.20**	.13**	.15**	.04
ELEC-CO-REQ	.04	- .01	.05	- .03
C-REA-PC	.13**	.07	.11**	.01
ESL-A+B	- .25**	- .05	- .26**	.08**
ABST-A+B	- .25**	- .09*	- .24**	.04
S-ATD-PS	- .12**	- .05	- .11**	.01

*p ≥ .05 if r ≥ .074
**p ≥ .01 if r ≥ .104

*p ≥ .05 if r ≥ .06
**p ≥ .01 if r ≥ .08

1 = Student characteristic
2 = Aptitude (SFTAA)
3 = Cognitive style (GEFT)

TABLE 4 (continued)

APTITUDE (SFTAA) AND COGNITIVE STYLE (GEFT) CORRELATIONS (r) WITH STUDENT CHARACTERISTICS: SECOND GRADE MATHEMATICS ($N \geq 850$)

CHARACTERISTIC (1)	APTITUDE (2)	COG. ST. (3)	APTITUDE -COG. ST. $r_{12 \cdot 3}$	COG. ST. - APTITUDE $r_{13 \cdot 2}$
SEX-PS	- .01	- .04	.01	- .04
SES-PS*	.43**	.23**	.38**	.01
SES-PQ	.34**	.19**	.28**	.02
M-ED-PQ	.39**	.22**	.33**	.03
F-ED-PQ	.43**	.24**	.37**	.02
M-MATH-PQ	.34**	.16**	.30**	- .01
F-MATH-PQ	.31**	.26**	.21**	.13**
P-ACT-PQ	- .06	- .11**	- .01	- .09**
F-THRU-PQ	- .19**	- .01	- .21**	.10**
HD-ST-PQ	- .19**	- .09*	- .16**	.01
TITLE I-PQ	- .05	- .07	- .02	- .05
BILING-PS	- .12**	- .08*	- .09**	- .02
REMED-PS	- .22**	- .10*	- .19**	- .02
MILUH-PS	- .09*	- .09*	- .04	- .06*
OTHER-PS	.13**	.09*	.10**	.02
PRESCH-PQ	.20**	.13**	.16**	.03
ELEC-CO-PQ	.05	- .01	.06*	- .03
C-REA-PQ	.11**	.08*	.08**	.02
ESL-A+B	- .25**	- .04	- .26**	.10**
ABST-A+B	- .21**	- .09*	- .20**	.03
S-ATD-PS	- .12**	- .06	- .10**	.00

*p $\geq$ .05 if $r \geq$ .074
**p $\geq$ .01 if $r \geq$ .104

*p $\geq$ .05 if $r \geq$ .06
**p $\geq$ .01 if $r \geq$ .08

1 = Student characteristic
2 = Aptitude (SFTAA)
3 = Cognitive style (GEFT)

TABLE 4 (continued)

APTITUDE (SFTAA) AND COGNITIVE STYLE (GEFT) CORRELATIONS (r) WITH STUDENT CHARACTERISTICS: FIFTH GRADE READING ($N \geq 1100$)

CHARACTERICTIC (1)	APTITUDE (2)	COG. ST. (3)	APTITUDE -COG. ST. $r_{12.3}$	COG. ST. - APTITUDE $r_{13.2}$
SEX-PS	.01	- .02	.03	- .04
SES-PS	.40**	.26**	.32**	.05
SES-PQ	.32**	.24**	.23**	.08**
M-ED-PQ	.33**	.21**	.27**	
F-ED-PQ	.34**	.23**	.26**	.05
M-MATH-PQ	.26**	.17**	.21**	.03
F-MATH-PQ	.31**	.24**	.21**	.09**
P-ACT-PQ	- .22**	- .13**	- .18**	- .01
F-THRU-PQ	- .04	- .04	- .02	- .02
HD-ST-PQ	- .17**	- .12**	- .12**	- .04
TITLE I-PS	- .11**	- .05	- .10**	.02
BILING-PS	- .07*	.00	- .09**	.05
REMED-PS	- .13**	- .13**	- .07*	- .06*
MILUH-PS	- .17**	- .11**	- .14**	- .01
OTHER-PS	.12**	.13**	.06*	.08**
PRESCH-PQ	.16**	.13**	.11**	.05
EL-CO-PQ	- .07*	- .12**	- .01	- .09**
C-REA-PQ	.12**	.06*	.10**	.00
ESL-A+B	- .17**	- .11**	- .13**	- .02
ABST-A+B	- .15**	- .07*	- .13**	.01
S-ATD-PS	- .01	- .04	.01	- .04

*
**p $\geq$ .05 if $r \geq$ .052
p $\geq$ .01 if $r \geq$ .074

*
**p $\geq$ .05 if $r \geq$ .06
p $\geq$ .01 if $r \geq$ .08

1 = Student characteristic
2 = Aptitude (SFTAA)
3 = Cognitive style (GEFT)

TABLE 4 (continued)

APTITUDE (SFTAA) AND COGNITIVE STYLE (GEFT) CORRELATIONS (r) WITH STUDENT CHARACTERISTICS: FIFTH-GRADE MATHEMATICS (N ≥ 1200)

CHARACTERISTIC (1)	APTITUDE (2)	COG. ST. (3)	APTITUDE -COG. ST. $r_{12.3}$	COG. ST. APTITUDE $r_{13.2}$
SEX-PS	.04	- .03	.06*	- .06*
SES-PS	.35**	.22**	.28**	.04
SES-PQ	.33**	.25**	.24**	.09**
M-ED-PQ	.29**	.19**	.22**	.05
F-ED-PQ	.32**	.21**	.25**	.05
M-MATH-PQ	.25**	.17**	.19**	.04
F-MATH-PQ	.28**	.22**	.19**	.09**
P-ACT-PQ	.22**	- .13**	- .18**	- .02
F-THRU-PQ	- .05	- .04	- .04	- .01
ED-ST-PQ	- .14**	- .12**	- .09**	- .05
TITLE I-PS	- .16**	- .08**	- .14**	.01
BILING-PS	- .05	.02	- .07*	.05
REMED-PS	- .13**	- .12**	- .08**	- .06*
MILUH-PS	- .18**	- .07*	- .16**	.03
OTHER-PS	.06*	.11**	.00	.09**
PRESCH-PQ	.10**	.08**	.06*	.04
EL-CO-PQ	- .04	- .09**	.01	- .08**
C-REA-PQ	.11**	.05	.10**	- .01
ESL-A+B	- .14**	- .07*	- .12**	.01
ABST-A+B	- .13**	- .06*	- .11**	.01
S-ATD-PS	- .02	- .04	.00	- .04

*p ≥ .05 if r ≥ .052
**p ≥ .01 if r ≥ .074

*p ≥ .05 if r ≥ .06
**p ≥ .01 if r ≥ .08

1 = Student characteristic
2 = Aptitude (SFTAA)
3 = Cognitive style (GEFT)

magazines at home. Field-dependent students at both grade levels are more likely to have participated in Headstart, Title I, or a special reading program, to be read to at home, and to be absent frequently.

Since aptitude is significantly related to these same variables and the correlation of cognitive style and our aptitude measure was between .49 and .55 for these groups, partial correlations were computed. With aptitude controlled, correlations which remain significant at the second grade are number of mathematics courses taken by father with field independence and participation in a Miller-Unruh reading program with field dependence. At the fifth grade level the variables significantly related to field independence are higher SES, father's mathematics courses and participation in a non-remedial, special school program. Participating in a remedial reading program and watching the Electric Company television program remain significantly related to field dependence. Thus, even with aptitude controlled for, there is a consistent relation between indices of higher SES and field-independence for the students in this sample.

5. Is field-dependence-independence differentially related to learning in different subject matters at different grade levels?

Correlations and first-order partial correlations for cognitive style, aptitude, and the student test scores are in Table 5. Significant positive correlations were found between GEFT scores and each of the student measures at both grade levels. When aptitude is controlled for, field independence continues to be significantly

TABLE 5

ZERO-ORDER AND PARTIAL CORRELATIONS [illegible] APTITUDE AND COGNITIVE STYLE WITH [illegible] MATHEMATICS SCORE [illegible] SPRING AND FALL; AND WITH [illegible] STUDENT EXPECTATION AND [illegible] ATTITUDE SPRING AND FALL: SECOND GRADE READING (N ≥ 750)

STUDENT SCORE (1)	APTITUDE (2)	COG. STYLE (3)	APTITUDE - COG. STYLE $r_{12 \cdot 3}$	COG. STYLE - APTITUDE $r_{13 \cdot 2}$
EXP-F	.27**	.22**	.19**	.11**
EXP-S	.35**	.23**	.28**	.07*
ATT-F	- .13**	- .08*	- .11**	- .01
ATT-S	- .24**	- .07*	- .23**	.05
SFTAA	1.00	.49**	1.00	—
COG. STY	.49**	1.00	—	1.00
R-CAT-F	.54**	.39**	.43**	.18**
R-CAT-S	.50**	.37**	.39**	.17**
R-APPL-F	.53**	.37**	.43**	.14**
R-APPL-S	.59**	.44**	.48**	.21**
DEC-T-F	.63**	.47**	.52**	.24**
DEC-T-S	.55**	.45**	.42**	.25**
R-ACH-F	.53**	.34**	.44**	.12**
R-ACH-S	.54**	.40**	.43**	.18**
R-TOT-F	.60**	.41**	.50**	.17**
R-TOT-S	.61**	.45**	.50**	.22**

*p ≥ .05 if r ≥ .074
**p ≥ .01 if r ≥ .104

*p ≥ .05 if r ≥ .06
**p ≥ .01 if r ≥ .08

1 = Student score
2 = Aptitude (SFTAA)
3 = Cognitive style (GEFT)

TABLE 5 (Continued)

ZERO-ORDER AND PARTIAL CORRELATIONS OF APTITUDE AND COGNITIVE STYLE WITH READING AND MATHEMATICS SCORES, SPRING AND FALL; AND WITH STUDENT EXPECTATION AND ATTITUDE SPRING AND FALL: SECOND GRADE MATHEMATICS ($N \geq 850$)

STUDENT SCORE (1)	APTITUDE (2)	COG. STYLE (3)	APTITUDE -COG. STYLE $r_{12 \cdot 3}$	COG. STYLE - APTITUDE $r_{13 \cdot 2}$
EXP-F	.36**	.28**	.26**	.12**
EXP-S	.33**	.23**	.26**	.07*
ATT-F	- .13**	- .08*	- .11**	- .01
ATT-S	- .20**	- .05	- .20**	.06*
SFTAA	1.00	.51**	1.00	—
COG. STYLE	.51**	1.00	—	1.00
M-CONC-F	.70**	.51**	.59**	.25**
M-CONC-S	.66**	.56**	.52**	.35**
M-COMP-F	.52**	.42**	.39**	.21**
M-COMP-S	.43**	.43**	.28**	.26**
M-APPL-F	.60** *	.43**	.49**	.17**
M-APPL-S	.52**	.49**	.36**	.30**
M-TOT-F	.65**	.49**	.54**	.23**
M-TOT-S	.56**	.50**	.40**	.30**

*p $\geq$ .05 if $r \geq$ .074
**p $\geq$ .01 if $r \geq$ .104

*p $\geq$ .05 if $r \geq$ .06
**p $\geq$ .01 if $r \geq$ .08

1 = Student score
2 = Aptitude (SFTAA)
3 = Cognitive Style (GEFT)

TABLE 5

(Continued)

ZERO-ORDER AND PARTIAL CORRELATIONS OF APTITUDE AND COGNITIVE STYLE WITH READING AND MATHEMATICS SCORES, SPRING AND FALL; AND WITH STUDENT EXPECTATION AND ATTITUDE SPRING AND FALL: FIFTH GRADE READING ($N \geq 1100$)

STUDENT SCORE (1)	APTITUDE (2)	COG. STYLE (3)	APTITUDE -COG. STYLE $r_{12 \cdot 3}$	COG. STYLE - APTITUDE $r_{13 \cdot 2}$
EXP-F	.25**	.08**	.24**	- .07*
EXP-S	.23**	.10**	.21**	- .03
ATT-F	.25**	.07*	.26**	- .08**
ATT-S	.33**	.15**	.30**	- .04
SFTAA	1.00	.55**	1.00	—
COG. STYLE	.55**	1.00	—	1.00
R-CAT-F	.80**	.48**	.73**	.07*
R-CAT-S	.77**	.48**	.69**	.09**
R-APPL-F	.66**	.40**	.57**	.05
R-APPL-S	.63**	.44**	.51**	.15**
DEC-T-F	.69**	.50**	.57**	.20**
DEC-T-S	.63**	.51**	.48**	.25**
R-ACH-F	.72**	.41**	.65**	.02
R-ACH-S	.69**	.46**	.60**	.12**
R-TOT-F	.83**	.49**	.77**	.06*
R-TOT-S	.79**	.52**	.71**	.16**

*p $\geq$ .05 if $r \geq$ .052
**p $\geq$ .01 if $r \geq$ .074

*p $\geq$ .05 if $r \geq$ .06
**p $\geq$ .01 if $r \geq$ .08

1 = Student score
2 = Aptitude (SFTAA)
3 = Cognitive style (GEFT)

TABLE 5
(Continued)

ZERO-ORDER AND PARTIAL CORRELATIONS OF APTITUDE AND COGNITIVE STYLE WITH READING AND MATHEMATICS SCORES, SPRING AND FALL; AND WITH STUDENT EXPECTATION AND ATTITUDE SPRING AND FALL: FIFTH GRADE MATHEMATICS ($N \geq 1200$)

STUDENT SCORE (1)	APTITUDE (2)	COG. STYLE (3)	- COG. STYLE $r_{12 \cdot 3}$	COG. STYLE - APTITUDE $r_{13 \cdot 2}$
EXP-F	.27**	.15**	.23**	.00
EXP-S	.21**	.16**	.15**	.06*
ATT-F	.25**	.07	.26**	-.08**
ATT-S	.31**	.11**	.29**	-.06*
SFTAA	1.00	.54**	1.00	—
COG. STYLE	.54**	1.00	—	1.00
M-CONC-F	.70**	.48**	.60**	.16**
M-CONC-S	.71**	.52**	.59**	.23**
M-COMP-F	.63**	.44**	.51**	.17**
M-COMP-S	.59**	.44**	.46**	.18**
M-APPL-F	.72**	.50**	.62**	.20**
M-APPL-S	.72**	.55**	.61**	.28**
M-TOT-F	.72**	.50**	.62**	.19**
M-TOT-S	.68**	.51**	.56**	.23**

*$p \geq .05$ if $r \geq .052$
**$p \geq .01$ if $r \geq .074$

*$p \geq .05$ if $r \geq .06$
**$p \geq .01$ if $r \geq .08$

1 = Student score
2 = Aptitude (SFTAA)
3 = Cognitive style (GEFT)

related to all the reading and mathematics measures at both grade levels, and inconsistently related to the expectation and attitude measures.

As expected, the amount of variance in student scores attributable to cognitive style is generally higher for the mathematics measures than for the reading measures. The one exception is the Decoding Test, performance on which requires a skill very similar to disembedding. However, the variance accounted for by cognitive style decreases between second and fifth grade for each of the reading and mathematics measures except decoding, while the variance accounted for by aptitude increases. This finding supports our hypothesis that cognitive style is a mediating or process variable which has its greatest impact during initial learning.

6. To what extent does field-dependence-independence contribute to the learning of different reading and mathematics skills at the two grade levels?

Stepwise regressions of residual scores against student variables were performed for three reading and three mathematics measures, each of which represented somewhat different skills within their domain. The significant predictors for each of these measures are listed in Table 6 with their standardized regression weights and the contribution of each to R^2.

The student variables were stepped in according to the amount of variance in the residual score which each accounted for. For each of the measures cognitive style (in this case field independence) was one of the first four variables to enter the regression analysis.

TABLE 6

STEPWISE REGRESSIONS: RESIDUAL SCORES ON STUDENT VARIABLES, GRADE 2 ($N \geq 750$)

TEST	R^2	STEP #	FALL SCORE r2	VARIABLES	STANDARD REGRESSION WEIGHT	CONTRIBUTION TO R^2
CAT READING COMPREHENSION	.3018	4	48%	SES	.1288	.0113
				APTITUDE	.1169	.0109
				M. ED.	.1138	.0093
				COG. STYLE	.0870	.0066
ETS READING APPLICATION	.4774	4	38%	APTITUDE	.2845	.0672
				EXP	.1648	.0266
				M. ED.	.1609	.0250
				COG. STYLE	.1479	.0187
ETS DECODING	.2123	4	68%	M. ED.	.1312	.0173
				COG. STYLE	.1187	.0140
				ATTITUDE	.0837	.0070
				EXPECTATION	.0730	.0053
CAT MATH CONCEPTS	.4153	4	60%	COG. STYLE	.2498	.0581
				APTITUDE	.1534	.0206
				EXPECTATION	.1685	.0280
				SES	.1245	.0146
CAT MATH COMPUTATION	.2983	4	36%	COG. STYLE	.1195	.0339
				ATTITUDE	.1260	.0155
				APTITUDE	.1060	.0093
				EXPECTATION	.0753	.0054
ETS MATH APPLICATION	.4100	5	33%	COG. STYLE	.2583	.0575
				APTITUDE	.1333	.0139
				EXPECTATION	.1143	.0121
				F. ED.	.1552	.0140
				SES	.1008	.0062

APTITUDE: SFTAA
COGNITIVE STYLE: GEFT

TABLE 6
(Continued)

STEPWISE REGRESSION: RESIDUAL SCORES ON STUDENT VARIABLES, GRADE (N≥1100)

TEST	R^2	STEP #	FALL SCORE r^2	VARIABLES	STANDARD REGRESSION WEIGHT	CONTRIBUTION TO R^2
CAT READING COMPREHENSION	.4236	4	58%	APTITUDE	.3616	.1122
				M. ED.	.0751	.0055
				COG. STYLE	.0745	.0049
				ATTITUDE	.0709	.0049
ETS READING APPLICATION	.4673	3	28%	APTITUDE	.3587	.1018
				COG. STYLE	.1346	.0148
				F. ED.	.1014	.0097
ETS DECODING	.2299	3	67%	COG. STYLE	.1693	.0254
				APTITUDE	.0824	.0058
				F. ED.	.0618	.0037
CAT MATH CONCEPTS	.4490	5	55%	APTITUDE	.2965	.0758
				COG. STYLE	.1756	.0273
				ATTITUDE	.0810	.0052
				M. ED.	.1089	.0113
				EXPECTATION	.0823	.0054
CAT MATH COMPUTATION	.2878	4	66%	APTITUDE	.1595	.0207
				EXPECTATION	.1206	.0145
				COG. STYLE	.1066	.0098
				SES	.0907	.0076
ETS MATH APPLICATION	.4937	4	50%	APTITUDE	.3488	.1056
				COG. STYLE	.2176	.0430
				M. ED.	.0786	.0060
				ATTITUDE	.0750	.0054

APTITUDE: SFTAA
COGNITIVE STYLE: GEFT

For the reading comprehension and reading application measures, aptitude contributes more to learning than does cognitive style at both grade levels. However, for the decoding measure, cognitive style's contribution is greater: indeed at the second grade aptitude is not a significant predictor.

For the three mathematics measures — concepts, computation, and application — cognitive style is the best single predictor of learning at the second grade, while aptitude is the best single predictor at the fifth grade.

In addition, with the exception of decoding, the contribution of cognitive style to learning is greater at the second grade than it is at the fifth grade for each of the measures. This further supports our hypothesis that cognitive style is a process variable which has its greatest impact when a person is first learning a series or pattern of skills.

In summary, for teachers cognitive style is significantly related to aptitude, satisfaction, and certain performances for specific subject matters and grade levels. It is not consistently related to those teaching performances which predict student learning.

For students, cognitive style is differentially related to student learning for different subject matters and at different grade levels. Except for decoding, cognitive style contributes more to learning in both reading and mathematics at the second grade level than it does at the fifth grade level. In addition, while the contribution of cognitive style to learning decreases

between second and fifth grade, the contribution of aptitude increases. Our findings consistently support the hypothesis that cognitive style, acting as a mediating or process variable, has more impact when a child is first learning these particular reading and mathematics skills.

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